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PROCEEDINGS
OF
THE ROYAL IRISH ACADEMY.

1840.

No. 22.

April 13.

SIR W^M. R. HAMILTON, LL.D., President, in the Chair.

Samuel Hanna, M. D., William Torrens M'Cullagh, Esq., George M'Dowell, Esq., F. T. C., John Ball, Esq., Rev. Dr. Traill, Robert Alexander Wallace, Esq., and Thomas Newenham, Esq., were elected Members of the Academy.

Dr. Apjohn, on the part of Surgeon Grimshaw, drew the attention of the Academy to a modification of the air-thermometer recently devised by the latter gentleman. The well-known objection to the ordinary air-thermometer he stated to be, that the air within the ball being in communication (through the interposed column of fluid) with the external air, its volume comes to be affected not merely by changes in the temperature of the surrounding medium, but by the perpetually occurring variations in the atmospheric pressure. In fact, to render its indications truly thermometric, they must be reduced by calculation to a constant pressure, reference being made in every observation to a correct barometer. Nor did Sir John Leslie, in his differential thermometer, get rid of this difficulty. It is true that all con-

nexion of the air within the instrument with the external atmosphere is cut off; but when one of the balls is heated, and the elasticity of the air within it thus augmented, and the intervening column of fluid driven towards the cool ball, the elasticity of the air within the latter is also obviously increased by compression. Equal increments of temperature cannot, therefore, produce equal augmentations of volume, and, when the stem of such an instrument is divided into parts of equal capacity, the corresponding temperatures constitute, not an arithmetical series, but one which increases much more quickly. In fact, if t be the temperature, v the volume of the air in the heated ball, and v' the volume of air in the cool ball, t varies not as v , but as $\frac{v}{v'}$.

This source of embarrassment in the air thermometer Mr. Grimshaw removes by a contrivance, a notion of which may be simply conveyed by describing his instrument as a differential thermometer, in the cool ball of which is placed a barometer, while to the side of the same ball a little syringe is attached, by means of which air may be pumped in or out, and the elasticity of the included air thus rendered invariably the same, before the temperature (exhibited upon the scale of equal parts attached to the stem in connexion with the hot ball) is registered. Two forms of this instrument were placed on the table of the Academy, which, however, Dr. Apjohn stated should be considered rather as rough models, than as finished instruments. Dr. Apjohn observed, that Mr. Grimshaw intended attaching to his thermometer a provision for keeping the barometer vertical; and marking upon this latter instrument two additional points of constant pressure,—one higher, the other lower, than the atmospheric standard,—by the use of which, when necessary, the scale of the instrument may be greatly extended, so as to comprehend with ease the entire of the atmospheric range of temperature.

Dr. Apjohn read a paper on the subject of an essential oil not long since observed during the rectification of common whiskey. This substance he received in December, 1838, from Mr. Scanlan, who had it from Mr. Bowerbank, an eminent London rectifier. Shortly previous to this time, it was observed by Mr. Eneas Coffey, the inventor of the celebrated patent still, in the faint receiver at the extensive distillery of Sir Felix Booth; and Mr. Scanlan himself, upon coming over to Dublin, and visiting the establishment of Mr. Busby, at Blackpitts, recognized this same oil precisely where it was observed by Mr. Coffey, namely, in the vessel into which the weak spirit which comes over towards the close of the distillation is conducted.

Dr. Apjohn stated in detail the properties of this fluid, and the experiments which he made with the view of determining its composition. It was burned in the usual way with oxide of copper, and gave, as the means of three separate experiments, the following results:—

Carbon.	68.13
Hydrogen	13.33
Oxygen	13.54
	<hr/>
	100

The most simple formula corresponding nearly with these results is $C_5 H_6 O$, and it was therefore that which he adopted. Assuming it as the true one, the composition of the oil would be,—

Carbon.	68.60
Hydrogen	13.45
Oxygen	17.95
	<hr/>
	100

The deficiency in the carbon, experimentally determined, is not greater than what usually takes place. But the error

in the hydrogen, though trifling in amount, being upon the opposite side to that on which it usually occurs, it became expedient to resort to some method of verification. The specific gravity of the vapour of the oil was therefore taken by the well known method of Dumas, and found to be 3.137: the formula C_5H_6O would make it 3.072. But there is here so close a correspondence between experiment and calculation, that no doubt can remain as to the correctness of the basis on which the latter rests, or that the formula already arrived at represents correctly the constitution of the oil.

These experiments were made in the winter of 1839, and Dr. Apjohn stated that he was then under the impression that the oil in question was a new substance, or rather one which had not been previously described. Some months after, however, upon looking over the second part of Professor Graham's Elements of Chemistry, he was surprised to find (in a table of the volumes of atoms in the gaseous state,) mention made of a substance under the designation of "oil of the ardent spirits from potatoes," to which was attributed the very same formula, and density of vapour, which he had found to belong to the oil of *corn* whiskey, given him by Mr. Scanlan. Anxious to investigate the matter further, and to ascertain whether the two oils were certainly the same, Dr. Apjohn looked into Dr. Thomson's fifth volume on Organic Chemistry, and found there (page 481) a notice of the potato oil, with a reference to the 30th and 56th volumes of the *Annales de Chimie*, in the former of which its origin and properties are described by Pelletan, and in the latter of which its analysis is given by Dumas. Upon perusing these papers, his suspicions as to the identity of the two oils were confirmed. In composition and properties they are the same; the only difference being, that Pelletan represents the potato oil as having the specific gravity .821, whereas Dr. Apjohn found that of the corn oil but .813,—a

difference, however, easily explained by the circumstance of the former chemist not having taken the necessary steps for purifying perfectly the liquid he examined.

As a very unusual coincidence it may be observed, that the specific gravity of the vapour of potato oil, as obtained by Dumas, is 3.147, or but unity in the second place of decimals greater than has resulted for the corn spirit oil from Dr. Apjohn's experiments. The oil therefore of Pelletan and Dumas is not, as is generally supposed, peculiar to potato spirit, but occurs also in that developed by the fermentation of the cerealia. From this latter source also it admits of being obtained in great quantity. When first observed by Mr. Coffey at Sir Felix Booth's, there was an inch of it in the faint receiver; and from the diameter of this vessel he estimated its total amount to be at least fifty gallons. This is the quantity produced at that establishment every fortnight, the excise laws compelling the distiller to distil and brew alternately, and about a week being consumed in each process.

The whiskey manufactured some years ago contained, Dr. Apjohn observed, a considerable quantity of this oil, and owed to its presence a great deal of the pungency of taste and smell by which it was distinguished. From the nature of the still at present generally used, but a small portion of this substance passes over; and hence the reason why the spirit now made is, as compared with the product of the old processes, less disagreeable to the palate, and probably less injurious to the constitution. It is undoubtedly owing to the same cause, (an improvement in the process of distillation,) that this oil has at length been noticed in the distillers' fairs. Upon the old system of manufacture the greater portion of it was driven over, and was held dissolved by the spirit into which it was thus introduced; but with the modern stills, particularly that devised by Mr. Coffey, nothing having so high a boiling point as this oil, can by pos-

sibility pass into the part of the apparatus where the spirit is condensed.

Dr. Apjohn proceeded to observe, that the potato spirit oil, as it has been hitherto called, has of late attracted much of the attention of chemists. Pelletan, from some rough experiments upon it with acids, threw out the idea that it was more analogous to alcohol than to the volatile oils, and this opinion seems to have been in some measure adopted by Dumas. More recently M. Auguste Cahours (Annales de Chimie, January, 1839) has revived this opinion, and concluded it to be one of the groups including alcohol, pyroxilic spirit, and acetone. He represents it by the formula $C_{10}H_{12}O_2 = C_{10}H_{10} + 2H_2O$, which obviously makes it quite analogous to alcohol in composition. The carbo-hydrogen $C_{10}H_{10}$ he has insulated, by distilling the oil from anhydrous phosphoric acid. He calls it *amilene*, and finds the specific gravity of its vapour to be 4.904, so that an atom of it gives but one volume of vapour,—a circumstance in which, as Cahours observes, it agrees with Dr. Kane's mesitylene, but differs from the carbo-hydrogens C_4H_4 and C_2H_2 which occur in alcohol and pyroxilic spirit. By acting upon potato spirit oil, (or, as Cahours calls it, amilic alcohol,) with sulphuric acid and chlorine, he obtained products corresponding perfectly with those yielded by ordinary alcohol when similarly treated. The amilic ether, or $C_{10}H_{10} + HO$, he did not succeed in insulating.

Dr. Apjohn observed, in conclusion, that he had been aware, for more than twelve months, of the identity of the fluid oil which he had examined with the potato spirit oil of the French chemists; but having engaged in the examination of another oil, of the consistence of butter at ordinary temperatures, which is well known to exist in corn spirit, it was his intention, when he had completed his experiments upon it, to give publicity to what he knew of both oils in the same paper. In the mean time, however, Liebig and Pelouze

published their memoir (*Annales de Chimie et de Physique*, tom. 63, p. 113,) upon an oleaginous matter, which comes over during the distillation of wine, towards the close of the process, and which they showed to be a mixture of what they denominated œnanthic acid with œnanthic ether. Having perused this paper, Dr. Apjohn felt satisfied, from the progress he had already made in the investigation, that the buttery matter found in small quantity in ordinary whiskey, and to a much greater amount in the distillers' fainits, was in a great measure the same with the substance which the chemists just named had found to come over during the distillation of wine in the production of brandy. A third oil, however, different from the œnanthic acid and œnanthic ether, he soon found to be present; and while occupied in examining it, his attention was directed by Dr. Kane to the 2nd part of Poggendorf's *Annalen* for 1837, which contained a paper on the subject of these products, by a German chemist named Mulder. In this paper it is satisfactorily shown that the solid oil of malt and corn spirit is a mixture of the oil of wine of Liebig and Pelouze, with a third substance, which he called *oleum siticum*. Being thus clearly anticipated as respected the solid oil, Dr. Apjohn observed that he had no motive for further delay; and he accordingly submitted to the Academy the facts from which he was enabled to conclude that the fluid oil (or amilic alcohol of Cahours) is not, as is generally thought, peculiar to potato spirit, but occurs also in that which is manufactured in this country by the fermentation of a mixture of malted and unmalted grain.

DONATIONS.

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences. Premier Semestre, 1840. Nos. 6—12. Presented by the Academy.

Proceedings of the Numismatic Society of London, 1837-38. Presented by the Society.

The New County Book of Tipperary. By Jeffries Kingsley, Esq., M. R. I. A. Presented by the Author.

An Essay on the Mineral Structure of the South of Ireland. By Thomas Weaver, Esq., M. R. I. A. &c. Presented by the Author.

A Letter to the President of the Royal Irish Academy. By Sir William Betham, M. R. I. A., &c. Presented by the Author.

An Essay on the Heat of Vapours and on Astronomical Refractions. By John William Lubbock, Esq. Presented by the Author.

Greenwich Observations for 1838. Presented by the Astronomical Society.

Bulletins de l'Académie Royale des Sciences et Belles-Lettres de Bruxelles, année 1839. (Nos. 5 and 6.) Presented by the Academy.

Annuaire de l'Academie Royale des Sciences et Belles-Lettres de Bruxelles, pour les Années 1839-40. Par le Directeur A. Quetelet. Presented by the Author.

Notice sur Martin van Marum. Par A. Quetelet. Presented by the Author.

De la Liberté Physique et Morale. Par L. A. Gruyer.

Examen critique d'un Mémoire de M. P. Leroux, intitulé, Du Bonheur. Par L. A. Gruyer.

Presented by the Author.

ABSTRACT OF THE ACCOUNT OF THE ROYAL IRISH ACADEMY, FOR THE YEAR ENDING MARCH 31st, 1840.

THE CHARGE.			THE DISCHARGE.		
	£	s. d.		£	s. d.
Balance in favour of the Academy, April 1st, 1839	130	11 9	House, Coals, Candles, &c.	45	17 6
Parliamentary Grant, Session 1839	200	0 0	Repairs of House, Furniture, &c.	135	3 9
Treasury warrants for Rent and Taxes	146	17 8	Rent, Taxes, and Insurance	148	10 11
Transactions sold	4	19 0	Salaries, Servants' Wages, &c.	68	19 10
Mr. Boone, London Bookseller, do.	11	19 0	Books, per Hodges and Smith	18	0 0
Hodges and Smith	3	5 8	Taylor's Scientific Memoirs	1	5 6
£115 14s. 0d. Consols sold at 91½	106	0 0	Sharpe,	0	14 6
39 15 10 do. do. 91½	36	4 0	Oriental Translation Fund subscription, 2 years	21	0 0
One year's interest on £1500, 3½ Government Stock	52	10 0	Follen, subscription to Lives of distinguished Irishmen	0	16 6
One half do. do. 3 per Cent. consols	22	10 0	A Directory	0	4 0
Half year's do. on £1384 6s.	20	15 4	Bookbinding.—Mullen.	5	5 0
One year's rent of stable	207	18 0	Transcribing.—Address to Queen, per Smith	10	0 0
Subscriptions, Life Compositions	84	0 0	Book of Liamore, Curry	8	8 0
Entrance	277	4 0	Comparing do. O'Donovan	176	2 4
Annual, and Arrears			Printing.—Grainberry	1	4 0
			Morrison (Lithography)	4	3 0
			Johnson, advertising	149	4 0
			Engraving.—Branson	23	5 6
			Kirkwood	47	10 0
			Duncan	1	13 6
			Waller	5	6 6
			Stationery.—Hope	0	15 6
			Perry,	6	2 0
			Cunningham Medals	19	13 4
			Contingencies	68	0 2
			Total Discharge	1851	10 8
			Balance in favour of the Academy	74	3 9
			Total	1426	14 5

STATE OF THE BALANCE.

In Bank of Ireland, as per Certificate	£50	10 0
In Treasurer's hands	23	13 9
Balance as above	£74	3 9

April 13th, 1840.

Signed,

THOMAS HERBERT ORPEN, Treasurer.